measured amount of gelatin, on which papaïn works. No. 1 digested the gelatin much more rapidly than No. 2, while No. 3 was inactive. As both Nos. 1 and 2 contained the same amount of active enzyme, he considers it certain that the boiled solution contained some constituent necessary for the action of the papaïn. The solvent action of papaïn on gelatin thus requires the presence of two substances, the enzyme itself, which is split up and destroyed by heating, and another substance which is contained in the heated enzyme.

He considers subsequently at some length the group of oxidases, possessing in such a great degree the power of taking up oxygen and communicating it to the bodies which they attack.

The conclusion is that there exists in all enzymes the substance already alluded to, and that this is an iron-containing nuclein. He gives the name *bionuclein* to this hypothetical body.

It would be too long a task to follow the author through all the developments of his theory. They may be gathered from the statement he makes in his third chapter, that since the chemistry of all vital phenomena must be fundamentally the same, the processes which are the foundation of enzyme action must be also the foundation of all vital phenomena, and all must alike depend upon the oxidation of bionuclein. In his later chapters he deals with the behaviour of the cell substance, the fusion of sexual cells, the phenomena of karyokinesis, the phenomena presented by muscle and nerve and by the central nervous system.

The treatise is one which is deserving of careful consideration, though it is doubtful how far many of the author's conclusions will be held deserving of support.

TWO ASPECTS OF THE THEORY OF PROBABILITY.

Probabilités et Moyennes géométriques. By Emmanuel Czuber. Translated into French by Herman Schuermans, with a preface by Charles Lagrange. Pp. xii + 244. (Paris: A. Hermann, 1902.) Price Fr. 8.50.

Philosophical Essay on Probabilities. By Pierre Simon Marquis de Laplace. Translated from the sixth French Edition by Frederick Wilson Truscott, Ph.D., and Frederick Lincoln Emory, M.E. Pp. iv + 196. (New York: John Wiley and Sons; London: Chapman and Hall, Ltd., 1902.)

WE have here two books dealing with widely different aspects and applications of the theory of probability.

Prof. Czuber's treatise is a collection of problems relating to probabilities in which the number of cases of success and failure, instead of being finite or at any rate discrete, is continuously infinite. The cases considered relate to points chosen arbitrarily on a line, in a plane or in space, to lines drawn arbitrarily in a plane or in space, to surfaces taken arbitrarily in space, and to mean values depending on such random constructions. Such problems have a great interest for the pure mathematician, and they lead to a number of apparent paradoxes depending chiefly on what is meant by "taken at random," and many of these have been the subject of much controversy. No better preparation for the study of such paradoxes can be suggested than a comparison of the results of choosing a point so that all values of its Cartesian coordinates are equally probable with the corresponding results when all values of the polar coordinates are equally probable. The author has made an extended study of the problems proposed by various English writers in the *Educational Times*, of the writings of French mathematicians, and in particular of the important memoir of 1868 by Crofton. The result of this study has been the insertion of a number of historic notes and remarks, including a brief but full discussion of the famous "needle problem" of Buffon, *i.e.* the problem of calculating the probability that a needle dropped at random on a sheet of ruled paper should cross one of the ruled lines when the needle is too short ever to cross two lines. The author quotes Dr. Wolf's experimental tests, which gave a result falling well within the limits of probable error.

The second book is a translation of the famous philosophical essay by Laplace, which was originally based on a course of lectures given by him in 1795 at the École Normale when he was appointed professor of mathematics with Lagrange as a colleague. It is purely philosophical, and deals with general questions arising out of probabilities and hope, their applications to natural philosophy, to prediction of the decisions of juries and other assemblies, to problems of life insurance and to the dispersion of superstitions. In regard to the latter use, Laplace's words may well be quoted:—

"All these prejudices and the terrors which they inspire are connected with physiological causes which continue sometimes to operate strongly after reason has disabused us of them. But the repetition of acts contrary to these prejudices can always destroy them."

There are few illusions arising from a failure to appreciate the calculus of probabilities which have done so much harm in the world as that which has given rise to the confirmed gambler or speculator. The very definite mental impression produced by a valuable prize and the difficulty to form a tangible conception of the probability factor which reduces the expectation to one of loss have proved fruitful sources of revenue to organisers of lotteries. But there is another cause which prevents a study of the theory of probability from saving the gambler from ruin. If in a game of even chances red turns up twenty times in succession, it is still an even chance whether red or black turns up on the twenty-first time; but no amount of mathematical reasoning will enable the confirmed gambler to realise that a previous run of bad luck gives no grounds for the expectation of recovering his losses by a run of good luck in the future.

OUR BOOK SHELF.

Upland Game-Birds. By E. Sandys and T. S. Van Dyke. Pp. ix + 429; illustrated. (New York: the Macmillan Company; London: Macmillan and Co., Ltd., 1902.) Price 8*s.* 6*d.* net.

THIS is the first of a series of ten volumes on American game and fish, published under the title of the "American Sportsman's Library," which has come under our notice; and if its companions are anything near so good as the

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one before us, the series ought to command a large sale among both sportsmen and naturalists. Indeed, the mere fact that all the volumes are to be issued under the editorial supervision of Mr. Whitney, the well-known editor of *Outing*, ought of itself to be a sufficient guarantee that they will be all such works should be. The greater part of the volume under consideration is by the first of the two authors whose names appear on the title-page, Mr. Van Dyke merely contributing a small section—considerably less than 100 pages—on the game-birds of the Pacific coast.

Throughout the work, the authors appear to have hit the happy mean between a strictly scientific treatise and a purely sporting manual, each species being carefully described in accurate and, at the same time, popular language, while the rest of the space devoted to each is a pleasantly blended mixture of sport and natural history, enlivened by a number of racy anecdotes. Mr. Sandys evidently loves his subject, and, being himself an enthusiastic sportsman with a strong bias towards natural history and a delightful style of writing, it is little wonder that he has succeeded in producing a most interesting book. The volume commences with the "bob-white," the so-called American quail, and embraces all the species and varieties which can be classed as game-birds up to, and inclusive of, such a magnificent bird as the wild turkey, which the author calls the king of wild birds. The scientific nomenclature is thoroughly up-to-date—perhaps, indeed, almost too much so, as Mr. Sandys follows those authorities who consider it necessary to separate the American woodcock generically from its European relative. A notable instance of the extreme degree of refinement to which modern American zoology is carried occurs in the case of the plumed partridge, which is stated to differ from the typical *Oreortyx pictus* chiefly by its predilection for a mountain habitat.

As an example of Mr. Sandys's powers of accurate observation and induction, we may refer to his account, p. 223, of the resemblance of the ptarmigan in winter dress to its surroundings. After mentioning that every projection above clean snow is apt to cast a more or less decided shadow and thus cause a darker spot, he observes that the black tail of the crouching ptarmigan so closely imitates this effect that the intelligent observer cannot fail to detect Nature's purpose in the one peculiar mark. In such a brief notice as our space allows, we cannot quote further, and can only say that the authors and the artists have combined to produce a most attractive and interesting little volume. R. L.

Wild Fruits of the Country Side. Figured and described by F. Edward Hulme, F.L.S., F.S.A. Pp. viii + 259; with thirty-six coloured plates by the author. (London: Hutchinson and Co., 1902.) Price 12*s.* 6*d.* net.

THIS work forms one of the "Woburn Series of Natural History," published under the auspices of the Duke of Bedford, and intended, as His Grace's preface shows, to supply to those who, from various circumstances, cannot devote themselves to the scientific study of natural history, some knowledge of the processes and products of Nature in a form at once easily assimilated and scientifically accurate.

The author himself amplifies this statement of his editor, and declares "Our purpose to be a very simple one, to deal with the principal typical forms that one may reasonably expect to meet with during a country sojourn, and to deal with them in the simplest way—caring but little to send our readers to the dictionary in a wild quest for six-syllabled words of weird appearance, but caring much if the result of the perusal of our pages be to so far interest them as to send them to seek for themselves in the great Book of Nature."

The class of people for whom this book is intended is further defined as including those who need to be told that "a privet berry and an acorn are distinguishable one from the other, that a beech nut and a blackberry are not so identical in form and colour but that practice and observation will enable us to tell which is which."

A much less pretentious book would surely have answered the purpose as well as this handsome volume. The nature of the text may be inferred from what has been said—it contains much pleasant gossip, but little information, and no pains have been taken to correlate or classify what there is.

The illustrations are pretty and well executed, but scrappy and wanting in detail; for instance, a fragment of the common yew and a similar morsel of the dogwood (Cornus) are placed together on the same plate without any particular reason and with no details. We can only suppose this has been done for the benefit of those who cannot distinguish a beech nut from a blackberry. The table of contents of the three chapters into which the book is divided is very full, but very unsystematic. The index is copious, but displays the same absence of method; for instance, the first entry runs thus, "Abnormal Chestnut Cluster, 128," but there is no corresponding reference under Chestnut or under Cluster, both more important words for the user of the index than that chosen to direct his research. In fine, we can but regret the expenditure of so much time, labour and money which might with so much greater profit have been bestowed on a work of a different character.

A word of praise is due to the printer and publisher, for paper, typography and illustrations (so far as they go) are all good.

Einführung in die Theorie der Doppelbrechung. By Heinrich Greinacher. Pp. 64; numerous figures. (Leipzig: Von Veit and Co., 1902.) Price M. 1.20.

THIS is a simple account of some of the leading phenomena of double refraction considered by the help of geometric methods. These are of the simplest type, no attempt being made to give rigorous proofs where any difficulty would be encountered. The booklet can, therefore, only be recommended to those who are unable to grasp the theory as usually given, but desire some explanation of the phenomena which they have met with experimentally. They are presumably acquainted with such phenomena, as no diagrams of the effects described are provided; these might be added with great advantage. The description is lucid, but meagre. If the attack were concentrated on the ellipsoid of elasticity and the wave surface instead of spread out over four surfaces, greater success would be achieved. A. W. P.

Physical Geography. By Margery A. Reid, B.Sc. With maps and illustrations by Bertha Reid. Pp. iv + 148. (London: Allman and Son, Ltd.) Price 2*s.* 6*d.*

THOUGH this little book contains so few pages, it is divided into twenty-four chapters, in each of which new subjects are introduced. The reader is thus hurried from one subject to another without explanation enough to make the work intelligible. Rivers and glaciers are described in a little more than two pages. Rain receives scarcely any attention and the rain-gauge is not described at all When the author seriously attempts an explanation she is successful, but the limited space has prevented her from doing justice to herself or her subject. Especially in the descriptions of experiments is the guidance insufficient. For instance, we read on p. 35, "Submerge a shoot of watercress in water. Bubbles of gas collect on it; if some of these be tested as they ascend through the water, they are found to be oxygen." How to catch one of these bubbles and test it under water would puzzle older students than those for whom the book is intended.

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